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**Agricultural conservation adoption in the US Midwest:
Needs assessment and evaluation of professional development for farm advisers**

by

Rachael L. Whitehair

A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Agricultural Education (Agricultural Extension Education)

Program of Study Committee:

Nancy Grudens-Schuck, Major Professor

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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University

Ames, Iowa

2019

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DEDICATION

To the Prairie Strips Project Team. This network of professionals is of the utmost collaborative nature and I am proud to have been a part of the crew. I hope this contribution assists your mission. I have learned so much from all of you, thank you for all you do for the land and its people.

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ABSTRACT

Systematic adoption of agricultural conservation practices in the Midwest is progressing at a gradual pace despite the degradation of habitat, soil, and water quality. Complex social and economic factors contribute to insufficient adoption including; financial risk, lack of technical supports, and poor perceived fit with current practices. Agricultural advisers, including extension educators, are trusted sources of guidance for conservation practice decisions and are familiar with farmers' needs. Prairie strips is a conservation Best Management Practice (BMP) made available around 2014 by Iowa State University and has potential to improve habitat, soil, and water quality if broadly applied across Midwest row crop fields. In 2017, a three-part program for farm advisers was held throughout the state of Iowa that included a workshop series, creation of a communication piece, and assisted consultation with a prairie strips client. The intention of the program was to prepare advisers to provide consultation to farmers and landowners on potential adoption of prairie strips. Farm advisers included government and nonprofit staff, and both private and independent contractors, including Technical Service Providers (TSPs), Certified Crop Advisors (CCAs), and Extension educators. Program development was refined using a needs assessment survey. Outputs included seven workshops; one of which was canceled due to low registration. The workshops were held throughout Iowa and designed to educate advisers on (a) research on prairie strips, (b) siting and design of prairie strips, (c) prairie identification and management, (d) incentive program eligibility, and (e) communication with farmers and landowners. The itinerary included interdisciplinary speakers and hands-on applications. Ninety-one attended from five Midwest states comprising various occupational areas. The evaluation for the workshop series utilized a pre and post skills test and an online survey. Participant ability to assess age and health of prairie showed little improvement as a result of instruction. Participants, however, indicated that confidence and abilities in this area

had improved. Advisers rated the value of additional supports during the workshops, including eligibility of prairie strips for government programs. Most attendees reported that they considered prairie strips to be a useful technology with potential to become a common BMP within the region, however, about half felt more research was needed. Management of prairie strips appeared to require skill levels that many advisers have not yet acquired.

CHAPTER 1. GENERAL INTRODUCTION

Brief Summary of the US Midwest Agroecosystem

The Midwest United States (US) is considered globally to be one of the most intensive areas of agricultural production. The majority of the landscape has been mechanized for production, removing nearly all of native grassland cover, and alteration continues each year (Lark, Meghan Salmon, & Gibbs, 2015). The rise in global demand for food, fuel, and fiber has intensified farm production at the expense of the region's ecosystem integrity (Hobbs & Harris, 2001; Riboudo, 2011; Walther, Hughes, Vitousek, & Stenseth, 2005). Moreover, agricultural production faces a future of considerable strain in the form of drought, extreme temperatures, and sporadic weather events (Hatfield et al., 2018). Corn and soybean production dominate Midwest farmland and these crops contribute greatly to resource degradation (USDA- NASS, 2018). Practices associated with row crop production contribute heavily to the decline of biodiversity, and soil and water quality. Accumulated nutrient and sediment runoff, and the transformation of native landscapes into tillable acres, are the main threats to ecosystem stability (Schmidt, Van Metre, & Carlisle, 2019; Schulte et al., 2017). For example, monoculture crop stands provide a haven for pest and disease invasion. This encourages combative practices including chemical application, causing adverse risk to the surrounding environment (Gajda, 2010; Newton, 2016). Conservation practices can greatly diminish the environmental impacts of row crop production. However, adoption of these conservation technologies is slower than other BMPs, despite proven benefits and evidence of long-term yield sustainability (Baumgart-Getz, Prokopy, & Floress, 2012).

Beginning with a watershed-scale experiment at the Neal Smith National Wildlife Refuge in Iowa, an Iowa State University research team developed the conservation practice: prairie strips. Since this BMP became available to farmers and landowners in 2014, ongoing research has expanded through Iowa and nearby states. Prairie strips are 20-30 foot-wide strips of native perennial plant mixtures placed strategically across the contour of hillslopes. Usually one to three strips are placed directly within a crop field acting as lateral catchments for soil and nutrients that would otherwise flow downward across the landscape (Schulte et al., 2017). Slowing soil movement helps maintain soil structure and allows nutrients to remain available for plant and microbial uptake. Prairie strips provide native habitat to support mammals, birds, and pollinating insects (Schulte et al., 2017; Stevenson, 2019).

The greatest barrier to progress in reducing nutrient export and improving habitat is the low numbers of acres of conservation BMPs installed on the landscape by Corn Belt farmers (Hatfield et al., 2014; Jones, 2007). Like these practices, the pace and scale of prairie strips adoption is limited because of complex factors such as incompatibility with current practices, low availability of technical supports, uncertain economic return on investment, and uncertain inclusion in current farm policy (Lovell & Sullivan, 2006; Schulte et al., 2017). Cooperating farmers have also reported that growing and maintaining prairie strips is very different from raising row crops (Arbuckle, 2016; 2017).

Barriers to Conservation

For farmers and society to reap the advantages, prairie strips must be adopted on a large number of acres. Profitable agricultural innovations follow a somewhat common path to systematic adoption, still considered slow despite immediate economic advantage (Rogers, 2003). In fact, potential adopters fall into five groups, each possessing a different set of characteristics and concerns (Arbuckle & Roesch-McNally, 2015; Rogers, 2003). However,

new technologies that mitigate soil fertility loss and water contamination have been shown to follow a much slower and more challenging path (Arbuckle & Ferrell, 2012; Reimer, Weinkauff & Prokopy, 2012). Cover crops are an example of a conservation practice considered to be low risk and can even provide short-term economic advantage (Carlson & Stockwell, 2013; Comito, 2016; Davis, Hill, Chase, Johanns, & Liebman, 2012). Despite Cooperative Extension's efforts to educate agricultural producers about the benefit of this technology, adoption remains less than desired by state policy makers with only 100,000 farmland acres out of Iowa's 30 million acres planted to cover crops in 2012 (Plastina, Liu, Miguez, & Carlson, 2018). As of 2019, cover crop acres are at just 880,000, far from the goal of 12.5 million called for by the Iowa nutrient reduction strategy (Juchems, 2019).

Research is currently directed toward understanding the needs and communication pathways of farmers and landowners who may potentially adopt agricultural conservation technologies (Baumgart-Getz et al., 2012). Major concerns among farmers and landowners include limited financial incentive programs, insufficient information, limited technical support, lower return on investment, policy uncertainty, and an anticipated poor fit of the technology with farm and family goals (Baumgart-Getz et al., 2012; Lovell & Sullivan, 2006). Adoption campaigns are directed towards raising awareness of financial benefits, on-farm environmental benefits, and compatibility potential with current farm management practices (Reimer et al., 2012). Farmers with high levels of confidence in their current practices exhibit the strongest apprehension when faced with the idea of adoption of practices like no-till farming and cover crops. However, farmers who visit with other farmers and observe their practices were more inclined to change current practices (Roesch-McNally, Arbuckle, & Tyndall, 2017). A multidisciplinary approach of both technical service providers

and university scientists and staff has been shown to improve adoption in the area of conservation BMPs, especially when utilizing pathways such as face to face interactions, field days, and workshops (Lovell & Sullivan, 2006).

The Prairie Strips Project

The Prairie Strips project team developed the practice to meet both ecosystem improvement and profitability goals for Midwest farmland. Prairie strips are 20 - 30-foot sections of 30 or more species of native C3 and C4 grasses like big bluestem or Indian grass, sedges, rushes, legumes like purple prairie clover, and forbs such as butterfly milkweed or pale purple coneflower. Strategically placed within row-crop fields, they act as pollinator and wildlife habitat while preventing common issues associated with agricultural production such as erosion and poor water quality (Figure 1) (Schulte et al., 2017).



Figure 1. Aerial view of prairie strips integrated within soybeans across the contour of the field. Photo by Lynn Betts (2017)

Awareness of the practice in 2015 among farmer populations was documented as low, with 81% reporting they had never heard of the practice strips (Comito, Pierce, & Stevenson, 2018). The 2018 report (Comito et al.) says that number has dramatically dropped with only 23% of respondents saying they had never heard of prairie. Prairie strips bring up similar adoption concerns when compared to other conservation Best Management Practices (BMPs) (Arbuckle, 2015; 2016; 2017). However, subfield-scale profitability analyses suggest transforming low performing sections of a field into perennial prairie vegetation can increase farmer's overall return on investment, potentially increasing field profitability by as much as 80% (Brandes et al. 2016; Jordahl & Kuckuck, 2018).

Research- based Characteristics

The STRIPS team conducted research to investigate the potential impacts of prairie strips and concerns of farmers and landowners related to adoption. Kordbacheh, Liebman, and Harris (2017) used multiple collection methods to determine that increasing forb and grass coverage leads to increased bee and predatory ground beetle abundance. Schulte et al. (2017) quantified ecosystem performance indicators including species richness, crop production, and chemical runoff in a 10% prairie strip field to a 100% row-crop field to illustrate that diversification within agroecosystems increase ecosystem performance and resilience. Gill, Cox, and O'Neal (2014) determined that plant species often recommended for prairie reconstruction may not be as attractive to beneficial insect communities, reasoning that buffer strips containing plants that provide floral resources are more likely to increase the abundance of beneficial insects. Midwestern farmers expressed concern that prairie roots, often growing deeper than crop roots, might puncture and clog tile lines. To address this, team members placed cameras inside crop field tile lines in fields cropped by corn and field with and without prairie and showed that prairie roots had not infiltrated agricultural drain

tile more than crop roots (Helmets, Grudens-Schuck, & Youngquist, 2019). As prairie strips adoption increases across Midwestern states, Extension educators and other farm advisers will benefit from research-based education regarding consultation and implementation of this new conservation BMP (Grudens-Schuck, Helmets, Youngquist, & Johnson, 2017).

Professional Development

Farm advisers were the focus of professional development programming. Farm advisers included government and nonprofit staff, and private and independent contractors, including TSPs and CCAs. Private and independent consulting is becoming a more common career among this group and farmers are utilizing their services regularly (Tallis et al. 2019). Haigh et al. (2018) suggest these individuals are trusted and that they understand client needs and preferences. Likewise, Haigh et al. (2015) suggests producers rely heavily on agricultural advisers for technical information and that advisers may serve well as communicators of conservation and climate change-related information. The majority of advisers are not prepared to provide consultation on prairie strips. Educating advisers in this area could result in expanding communication which could increase the pace of adoption. Advisers can operate on a site-specific basis and are mindful of the needs in the area they serve, acting as multipliers of technical support on nutrient management decisions (Tallis et al. 2019).

Program Summary

The main activity associated with the thesis was a three-part professional development program offered by the STRIPS team as an Iowa State University Extension and Outreach program from March, 2017 to September 2018. The program was called, Become a Prairie Strips Consultant. Part I involved participation in a full-day workshop covering content determined by team experience and learning outcomes earmarked by the needs assessment process. The seven workshops featured presentations on hydrology, prairie

ecology, agronomy, and finances, communications, and others. Part II required participants to create a communication piece (blog, video, pamphlet, app, grant proposal, radio/podcast) about prairie strips for use in their business or organization, and which was reviewed by the team. Those who completed Part II received a completion certificate. Part III partnered a member of the STRIPS team with an advisor to implement prairie strips on a client's land. A financial subsidy was provided for the workshop (\$250) and Part III (\$1,000). In fulfillment of my research assistantship I aided development of workshop curriculum, advertisement and planning of venues and speakers, as well as ongoing support for participants during fulfillment of Part II. I also conducted thesis research on the needs assessment survey analysis and reporting (Whitehair & Grudens-Schuck, 2017); and on the evaluation, including development of instruments, administration, analysis, and reporting.

Conceptual Framework for Program Planning

The framework for program planning elements utilized Caffarella and Daffron's (2013) eleven components for interactive program planning model (p. 29).

Interactive Program Planning for Adults

- Establishing a basis for the planning process
- Identifying program ideas
- Sorting and prioritizing program ideas
- Developing program objectives
- Preparing for the transfer of learning
- Formulating evaluation plans
- Determining formats, schedules, and staff needs
- Preparing budgets and marketing plans

- Designing instructional plans
- Coordinating facilities and on-site events
- Communicating the value of the program

The professional development program for farm advisors involved most components, but the thesis addressed (a) needs assessment (identifying program ideas, and sorting and prioritizing program ideas); and (b) evaluation (formulating evaluation plans).

Needs Assessment

We conducted a needs assessment to inform curriculum development and delivery. Caffarella and Daffron (2013) and Altschuld (2010) note that needs assessment may not be required in every program planning situation. However, it seemed important in the case of a new technology that we documented was unknown by farmers and landowners. Specifically, goals were to (1) better understand our audience's consulting roles, (2) gauge their experience with conservation practices, and (3) identify educational needs and workshop preferences.

Evaluation

The evaluation was based on an outcomes evaluation framework relied upon in the Cooperative Extension System, and described by Braverman, Engle, Arnold, and Rennekamp (2008). An outcomes model for program evaluation relies on the terms “output” and “outcomes” to indicate major stages of program gains (Caffarella & Daffron, 2013; Radhakrishna & Relado, 2009). This language is compatible with logic modeling (Knowlton & Phillips, 2013), an outcomes-driven approach to evaluation used in program planning and reporting for Cooperative Extension programs nationally (Duttweiler, 2008) and in Iowa (Iowa State University Extension and Outreach, 2017). Radhakrishna and Relado (2009) show how question formatting can reflect an outcomes orientation of an evaluation within an

extension survey. A logic model schema for the Become a Prairie Strips Consultant Program is provided in Appendix A.

Evaluation Methods

Two evaluation methods consistent with the outcomes approach were used to assess merit and worth of the program in delivering near term program outcomes of Part I, the workshops. First, a pre and post skill test was given during the workshops to assess progress toward learning goals for key technical content (Pratt, McGuigan, & Katzev, 2000). Second, the majority of the output items, and a few items regarding satisfaction and future needs, were assessed using an online Qualtrics (2017) survey sent to participants within one week of the workshop. The evaluation section also reports outputs, such as number of activities and number of participants, and their personal information (demographics).

Chapter Summary

This thesis contains the following: Chapter 2 presents a review of the literature on the topics of prairie integration, barriers to adoption, and effective programming for farm advisers; Chapter 3 is the report of the needs assessment prepared as a manuscript for submission to the *Journal of Extension*; Chapter 4 is a manuscript prepared for submission to the *Journal of Agricultural Education* that reports on the evaluation of the workshop series; and Chapter 5 provides general conclusions and recommendations.

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CHAPTER 2. REVIEW OF THE LITERATURE

A Mechanized Landscape

Temperate tallgrass prairie in the Midwest has been subject to severe fragmentation and alteration due to intensive agricultural production (Kremen & Ricketts, 2000; Kremen, Williams, & Thorp, 2002). The state of Iowa was once predominantly diverse prairie, but today, alternations to the landscape have resulted in a reduction to less than 0.1% of this habitat now scattered in small patches (Steinauer & Collins, 1996). The animals and plants that the prairie used to support, and the benefits it maintained, have mainly disappeared. This decline in habitat quality has raised concerns about the subsequent loss of ecosystem services provided by prairie landscapes, such as pollinator habitat, carbon sequestration, food-web support, and mitigation of soluble chemical runoff into streams and rivers (Schulte et al., 2017).

With much of the Midwest landscape dominated by row crop agriculture, there is consequently little natural habitat remaining for native species. The constant disturbance within agricultural landscapes has been shown to correspond with a decrease in insect diversity and abundance (Wheelock & O'Neal, 2016). Of these insect communities, pollinators play a crucial role in the production of many agricultural crops (Le Féon et al., 2010). Koh et al. (2016) found pollinator abundance to be negatively correlated with large areas of crops, not unlike most of the Midwest. A study by Wheelock & O'Neal (2016) exploring pollinator communities in corn and soybean fields found that a community of pollinators was able to persist through the constant disturbances associated with row crop production; however, most of these pollinator species were comprised of solitary, ground-nesting bees.

Agricultural land in the Midwest, which mainly has been established on tallgrass prairie sites, produces high yields but is experiencing several problems that are serious for both producers and for society. Monoculture environments are sometimes referred to as “green deserts” due to the lack of biodiversity and can perform as havens for specialized pests (Wechsler, 2015). Erosion from agricultural fields has been a constant source of soil loss since before the Dust Bowl, and continues today, despite policies and the availability of conservation technologies (Lovell & Sullivan, 2006). Topsoil is lost from wind and water erosion at an alarming rate of 5.5 tons per acre per year, nearly 10 times the rate of replenishment (Karlen, Tomer, Neppel, & Cambardella, 2008). Diaz and Rosenberg (2008) explain that as soil leaves the landscape, sediments containing nitrogen and phosphorus collect in groundwater sinks and streams, ultimately contributing to the hypoxic zone in the Gulf of Mexico. Jones, Nielsen, Schilling, & Weber (2018) calculated Iowa’s contribution of nitrate-nitrogen into the Mississippi River stream network to find this state produces 45% of the total nitrate load coming from the Upper Mississippi River Basin. The decline of environmental quality challenges the sustainability of annual row crop production and points to potential negative outcomes for agricultural industry. In response to these concerns, the Committee on Environment and Natural Resources (2010) created the US Hypoxia Task Force in 2008. An action plan called upon states within the Mississippi River basin to reduce and mitigate fluvial nitrogen and phosphorus to reduce the hypoxic zone and improve water quality. Producers are encouraged to implement improved land management strategies which protect soil from erosion and increase carbon sequestration and organic matter accumulation (Hatfield, Parkin, Sauer, & Prueger, 2012).

Several research-based BMPs are available to assist farmers in mitigating these anthropogenic effects without transforming more than minimal profitable acres. Practices endorsed by the Natural Resources Conservation Service (NRCS) could reduce negative effects of row-crop farming which include but are not limited to: no-till farming, grassed waterways, terraces, contour farming, cover crops, and prairie strips (NRCS, 2019). These practices work to reduce soil movement and build soil structure.

Prairie Strips

Prairie strips incorporate additional benefits for biodiversity and ecosystem stability (Schulte et al., 2017). Increasing native prairie area within agricultural landscapes holds potential to mitigate the negative effects of landscape mechanization while simultaneously offering support to surrounding ecosystems as well as crop production. Restored prairie areas provide more functional niche space in the form of additional floral resources for floriferous insects and habitat to support predatory insects than that of agricultural landscapes (Haaland & Gyllin, 2011). As diversity increases among plant and animal species, a positive feedback loop occurs. Increasing the diversity of flora grows the population of specialized consumers and the degree of food web complexity (Wetzel, Kharouba, Robinson, Holyoak, & Karban, 2016). Maintaining diversity within community composition and “functional niche space” continues to be a primary objective in prairie conservation and restoration efforts (Hernandez-Cumplido, Glauser, & Benrey, 2016; Schilling & Drobney, 2014).

Adoption, Communication, and Education

Understanding the body of research surrounding BMP adoption is critical if efforts to increase adoption of conservation BMPs are to succeed (Baumgart-Getz et al., 2012). Roger’s (2003) Diffusion of Innovations Theory is widely used to explain and predict the rate at which an idea or technology diffuses through a specific population. This model works

especially well when the technology offers immediate advantage, has testimonials of being well tested, is simple to learn, and individuals can “see it for themselves” (Simin & Jankovic, 2014). However, conservation BMP practices typically do not meet all or even a few of these characteristics, resulting in a slower rate of adoption (Arbuckle, 2017). Conservation practice adoption must be approached differently than other innovative technologies given they do not typically meet the above criteria and bring about additional barriers.

Research identifies two categories as predictors of adoption potential; farmer, and farm-related characteristics. Farmer characteristics such as age, education, and participation in programs and field days can affect willingness to adopt, with younger, more educated farmers who attend field days regularly fitting the description of the earliest adopters. Farm characteristics related to economy, like farm size, tenure, and soil quality have also proven to be a highly influential factor (Prokopy, Floress, Klotthor-Weinkauff, & Baumgart-Getz, 2008). Drost, Long, Wilson, Miller and Campbell (1996) surveyed farmer groups to learn the roots of apprehension to adopt. They identified primary limitations to be economic factors, availability of information, and federal farm program availability.

Fishbein and Ajzen (2010) provide a framework called, “The Reasoned Action Approach”. They suggest there is a distinct difference between an individual’s willingness to consider adoption and the action of adopting a changed behavior. A change in attitude is the first obstacle to enacting a change in behavior. Reimer et al. (2012) combined Fishbein and Ajzen’s (2010) contextual factors, and Roger’s (2003) list of perceived practice characteristics to depict a scenario in which both played a role in conservation adoption decision making. The researchers added perceived risk as a practice characteristic, which often translated as economic factors (Fuglie & Kascak, 2001). Conservation BMPs have been

called “disruptive innovations”, (p. 2) in that they do not follow the typical adoption process (Hasler, Olfs, Omta, & Broring, 2017). With increased risk, greater pushback is experienced from defenders of the “status quo” (Franz & Cox, 2012). Focus is placed on identifying unrecognized potential of BMPs to successfully provide value to farmers that is currently being missed or overlooked.

Lack of cost information is without a doubt one the greatest barriers to adoption, yet, not a great deal is known about financial consequences of conservation practice adoption. Incentive program use for EQIP (Environmental Quality Incentives Program) across the country shows that large farms are more likely to participate (Lambert, Sullivan, Claassen, & Foreman, 2007). Moreover, participation can be influenced by state political views, with greater environmental problem severity within the state leading to greater program participation (Reimer, Gramig, & Prokopy, 2013). There are few cost assessments available and those that are available lack clarity. Cost analyses often overlook specific “analytical parameters unique to BMPs” (Tyndall & Roesch-McNally, 2014). There is a need for assessment tools which are transparent, flexible and comparable across regions and between practices. For example, accurately calculating opportunity costs can be challenging. Opportunity costs are associated with forgone opportunities to convert land to profitable uses. They make up a large portion of the adopter overall expenditure and actually create the largest financial barrier to conservation BMP adoption (Sechi, Tyndall, Schulte, & Asbjornsen, 2008). Some frameworks in this area are beginning to emerge. Tyndall and Roesch-McNally (2014) applied a standardized approach to cost analysis on BMPs to formulate a framework which can be utilized by Extension personnel. Houser, Denny, Reimer, Marquart-Pyatt, and Stuart (2018) recommend Extension advisers tailor

conservation information to the farmers' individual practices and focus on improving efficiency as an avenue to encouraging behavioral change.

Extension Educators and Farm Advisers

For technologies in agriculture and conservation, education and communication play a crucial role in the adoption process, which seeks to create an informal clientele who would purchase and apply technologies (Baumgart-Getz et al., 2012). Education and communication are key in Rogers' (2003) Diffusion of Innovations Theory. Other central pieces are the quality of the educational curricular and the trust within professional relationships. The aspect of trust largely affects farmers' source selection when seeking out or receiving conservation information (Lemos, Lo, Kirchhoff, & Haigh, 2014; Mase, Babin, Prokopy, & Genskow, 2015). Borelli et al. (2018) reported that farmers trust other farmers and agribusinesses the most to provide them consultation on production management decisions but trust extension the most to provide them with climate change information. Edge et al. (2017) reported farmers generally accept nutrient management recommendations from information sources who also provide consultation on crop growth strategies. Farm advisers, including private and independent service providers, and extension advisers are key communication pathways for changing farmers' perceptions about their management practices (Mase et al., 2015; Mills et al., 2016).

For nutrient management decisions, row crop farmers continue to turn to the private sector for guidance as opposed to Extension. Arbuckle and Rosman (2014) claim this will fail to lead to widespread adoption. They suggest Extension should remain a focal source of information to encourage consistent widespread behavioral change. Row crop farmers value multiple sources of information including fertilizer dealers, crop consultants, seed suppliers, and university extension as sources of information, however, the number of sources used by a

farmer depends on whether they received a college education and the size of the farm. Larger farm operations consider information from an average of four sources (Houser et al., 2018).

It is not always known where private and independent sectors receive their information.

Training and partnerships with Extension can bring technical knowledge of both groups to the same standard of accuracy (Doll & Reimer, 2017).

Professional Development for Farm Advisors

Offering professional development for advisers could potentially capitalize on reach and validity of technical information being distributed by the private sector (Mutchler, Anderson, Taylor, Hamilton, & Mangle, 2006; Orfaly et al., 2005). Educating farm advisers to transfer Extension-sourced information may improve BMP adoption. Houser et al. (2018) interviewed Midwest row crop farmers to determine reasons why these farmers were not seeking Extension information. Farmers spoke of "conservative N rate recommendations, (b) a decline in public funding for outreach and research, and (c) inferiority of information compared to that of the private sector." To create more trust between the adviser and farmer, Houser et al. (2018) recommended an advising approach focused on meeting the client's financial goals and backed by university-led research trials and technical supports.

Programming for Agricultural Advisers

Programs can be used to encourage community or organizational growth, assist with a problem or a change, prepare an audience for an experience, or examine societal issues (Cafarella & Daffron, 2013). Program development requires systematic planning that is both meticulous and reflective (Altschuld & Eastmond, 2010). Caffarella and Daffron (2013) list 11 critical components within the Interactive Program Planning Model (p.29). Two of the components are associated with conducting needs assessment and another dedicated to evaluation planning.

Needs Assessment

A needs assessment is used to identify those principal content areas that will effectively satisfy intended outcomes, institutional mission, social and political realities, and current knowledge base of the intended audience (Altschuld & Eastmond, 2010; Borich, 2003; Caffarella & Daffron, 2013). According to Caffarella & Daffron (2013), a needs assessment is not always required for all aspects but serves well when a new program is being developed. Deciding which program ideas require a needs assessment process is part of the skillset of extension program planners (Ghmire & Martin, 2011) and other adult program planners (Caffarella & Daffron, 2013). Frequently, needs assessments determine discrepancies or educational need, described as the gap between an audience's current state and some desired outcome. Needs are often demographically unique and so, a needs assessment is shaped based on the context in which it is created (Altschuld & Kumar, 2010). New program areas, or program areas that have been unsuccessful in the past, benefit the most from needs assessment. Institutionally, needs assessment has an extensive history in Cooperative Extension (Garst & McCawley, 2015), providing processes important to strategic planning such as "environmental scanning" (Guion, 2010).

Needs assessment methods in agricultural and conservation education vary. Edgar, Edgar, McGuire, Rutherford, Doerfert, and Murphrey (2012) used the Delphi technique to understand how to improve agricultural communications for when food, crop, and livestock crises came to the public's attention. In the food sciences, Robertson, Boyer, Chapman, Eifert, and Franz (2013) combined a survey and observational data to understand food handlers' levels of competence in the workplace. The needs assessment process applied by Surls, Feenstra, Golden, Galt, Hardesty, Napawan, and Wilen (2015) included a literature search, a survey of local resource (service) providers, and interviews of community clientele

to assay clientele needs to prepare an urban agriculture education initiative. Franz (2015) endorsed a “data party” technique by employing participatory techniques which mixed professional and stakeholders’ groups to arrive at improved needs assessment. Layman, Doll, and Peters (2013) combined focus groups and individual interviews to refine ideas for Extension climate change education for crop farmers. Nationally and at the state level within Extension, needs assessment is ongoing and is built into the Plan of Work (POW) process. A needs assessment provides findings from several sources to assist program planners in development and evaluation planning.

An Outcomes Approach

The program planning literature offers many strategies, but because we offered an Extension program, we selected an outcomes framework, which was compatible with existing institutional models (Braverman, Engle, Arnold, & Rennekamp, 2008). Outcomes approaches link what is done (activities) with what we want to achieve (outcomes). Today, this is a common approach within Cooperative Extension, but has not always been. The outcomes approach in Extension became systematic with the passing of the Government Performance and Results Act (GPRA) in 1993 which required “all federal agencies to develop measurable performance objectives as part of the budget process” (Rennekamp & Engle, 2008, p. 18). The reader should note, literature arguing for “preprogram accountability” surfaced earlier than the passing of GPRA within the extension organization (Rennekamp & Engle, 2008).

The outcomes framework offers many different tools; however, Extension often utilizes logic models to organize programming efforts, improve accountability, and increase learning through the exchange of information and experiences (Knowlton & Phillips, 2013). A program logic model is a visual presentation of the program development and evaluation

process, depicting six general categories: situation and priorities, inputs, outputs, outcomes, impact, and evaluation which spans the entire process. Outcomes are dependent upon time and represented by three categories; short-term, medium-term, and long-term. Short-term outcomes are individual changes in attitudes, awareness, knowledge, or opinions immediately following an experience. Medium-term outcomes are anticipated actionable changes to behavior, decision-making, practice or policies. Long-term outcomes are often associated with lasting impacts to cultural, economic, environmental or social conditions (Caffarella & Daffron, 2013; ISUEO, 2017). The logic model links outcomes with program activities and the theoretical basis for the program.

Program logic models used both inside and outside of Extension typically maintain similar components but can differ in use and format. Radhakrishna and Relado (2009) combine aspects of both in their program logic model. In this study, evaluation questions were developed prior to process and outcomes planning to effectively determine whether the results were measurable and answered original questions. Rice, Rugg, and Davis (2016) featured a logic model developed by a team of youth development experts to implement the Minnesota 4-H Science of Agriculture Challenge program. For the first part of the Become a Prairie Strips Program, we looked at activities and participants as outputs of the workshop series and planned an evaluation to assess short term outcomes.

Evaluation

A program evaluation is the systematic method of collecting and analyzing data about the effectiveness and value of one or more parts of the program and communicating this information to program staff, stakeholders, and funders (Caffarella & Daffron, 2013). Evaluations in Extension are part of the Plan of Work process and are either developed as an instrument to improve programs as they are happening (formative) or used to prove the

program's effectiveness once it has ended or is near completion (summative). Evaluation can also be used to determine Extension's broad public worth (Franz, Arnold, & Baughman, 2014).

The most popularized logic models depict evaluation as a component that spans the entirety of the process. Aspects like resources and stakeholder preferences take part in determining what aspect of the logic model is evaluated within the appropriate time frame (Caffarella & Daffron, 2013). Generally, there are three types that span the program development process from beginning to end; (1) a planning evaluation, conducted to assess program objectives; (2) a process evaluation to assess how the program is designed and delivered to meet audience needs; and (3) an outcomes evaluation, to determine and communicate whether or not objectives were met and to what extent change should occur as a result of a program (McDavid & Hawthorn, 2006).

The outcomes approach to evaluation compares the program's outcomes against its own objectives using both formal and informal methods. Formally collected data provides a greater degree of accountability and is expected by Cooperative Extension stakeholder audiences. For example, Duke and Norton (2017) used a retrospective questionnaire to assess and report the effectiveness of a community education program. Rector, Bakacs, Roew, and Barbour (2016) used a case study approach by collecting observational and survey-based data to assess the integrity of a program compared to foundational goals. Evaluators in Extension are accustomed to shaping their evaluation questions to elicit outcomes (Radhakrishna & Relado, 2009). However, Lamm, Israel, and Diehl (2013) suggest Extension staff skills in evaluation are mainly in the area of short term gains and may not have the full range of skills (including the use of logic models) to expand into far term outcomes evaluation. Far term

outcomes describe the lasting change that occurred within the organization or community as a result of the program. The evaluation reported here utilized a summative (end of workshop), outcomes-based approach.

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CHAPTER 3. NEEDS ASSESSMENT TO DEVELOP CROP LAND CONSERVATION PROGRAMMING FOR FARM ADVISERS

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Abstract

Educating farm advisers in technical, economic, and communications aspects of adoption of conservation techniques improves uptake among farmers and landowners. Midwestern advisers were surveyed to assess educational needs regarding a new row crop conservation practice, prairie strips, and to gauge preferences for programming. Findings showed that advisers' self-ratings were low on knowledge of prairie species identification, cost of prairie strips establishment, siting of prairie strips, and overall management. Most had never discussed prairie strips with a client, although three-quarters reported that their access to

potential adopters was high. Advisers preferred a nearby location, speakers with combined technical and research backgrounds, and follow-up technical support.

Keywords: agricultural education, adoption, best management practices, native species, prairie strips

Introduction

Extension educators who plan agriculture and natural resource programs conduct needs assessments for several reasons. High quality instruction depends, in part, on identifying needs, including content areas that interest, and are important to, members of intended audiences. The land-grant model has long history of collaborating with audiences and partners in the development of program needs (Garst & McCawley, 2015). The Extension organization has the wherewithal to conduct a range of needs assessment processes (Ghimire & Martin, 2011). Individuals charged with conducting these processes possess a range of skills (Garst & McCawley, 2015; Ghimire & Martin, 2011). This article reports on a needs assessment used to design a program to accelerate implementation of prairie strips, a conservation Best Management Practice (BMP), on Midwest crop land.

Needs Assessment

Altschuld and Eastmond (2010), Caffarella and Daffron (2013), and Borich (1980) summarize needs assessment processes as those which assist programs to satisfy intended outcomes, serve institutional missions, address social and political realities, and assess the knowledge base of the intended audience. Needs assessment may be distinguished as Level 1 or Level 2 (Altschuld & Eastmond, Jr., 2010). Level 1 assessments seek information from direct users, such as farmers, homeowners, and youth. Level 2 audiences are Extension educators, 4-H leaders, or watershed coordinators who, in turn, serve Level 1 audiences. Programs for Level 2 individuals may be termed professional development or more casually, “train the trainers.” Level 2 programs require attendees to comprehend the same content

matter as users, but often at a higher level. Level 2 professionals must also demonstrate ways to effectively convey information to users, and support users' transfer of learning to the workplace and the home (Caffarella & Daffron, 2013). For example, Barbercheck et al. (2009) examined the farm management educational needs of Level 1 female farmers in Pennsylvania. The survey collected demographics and information on social barriers and information gaps. Jeannette, Eubanks, Lawrence, and Radhakrishna (2016) reported on a needs assessment which collected survey data from Level 2 Master Gardener volunteers nationally regarding comfort and willingness to partake in social media training. The Master Gardening program planned to increase online content and wanted to know if these volunteers were prepared to assist in digital delivery to direct users.

Prairie Strips Programming

Prairie strips are conservation features composed of native perennial species placed on farm fields to address multiple environmental concerns. Prairie strips required new programming in order to increase adoption on crop land in the Midwest. Prairie strips protect soil and water and enhance wildlife habitat (Asbjornsen et al., 2013). The technology moved into the development and outreach phase from the research phase around 2014 (Schulte et al., 2017). The strips are 20 to 30 foot wide plantings and contain 30 or more species of tallgrass prairie grasses, legumes, and forbs (Schulte et al., 2017). They are planted within corn or soybean fields, often on the contour, and as edge of field buffers (Grudens-Schuck, et al., 2017). The perennial and multi-species character of the strips requires management different from better known conservation practices like grassed waterways (Schulte et al., 2017). Gaps in knowledge among farmers, landowners, and their advisers about novel features of prairie strips had been documented in informal needs assessments by members of the prairie strips team. This informal needs assessment phase led to the production of Extension and outreach

publications, videos, web pages, and presentations (Doudna, O’Neal, Tyndall, & Helmers, 2015; Grudens-Schuck et al., 2017; de Kok-Mercado, 2019).

The need for outreach was greater than the team, or sets of resources, could provide, however, so the team sought to partner with Level 2 advisors from extension and other public and private organizations who already had access to, and maintained relationships with, farmers and landowners. Many already work with farmers and landowners in the area of conservation BMPs. Studies consistently showed that Midwestern corn farmers trusted, and were comfortable with, Extension staff, Soil and Water Conservation District staff, and Natural Resources Conservation Service (NRCS) staff, as well as with Certified Crop Advisers (CCAs), and input dealers, when receiving technical agronomic information, including climate-change information (Mase, Gabin, Prokopy, & Genskow, 2015; Prokopy & Power, 2015). The team regarded the choice of advisers as “multiplier” partners as sound. The program, Become a Prairie Strips Consultant, was designed in three-parts: a workshop; an adviser-created communications piece; and working with a client to implement prairie strips, mentored by a team member.

What do Advisers Know? What do They Need?

A distinguishing feature of prairie strips is its “prairie nature.” Farmers and advisers are typically unfamiliar with ecological indicators that signal healthy prairie landscape diversity and healthy prairie succession (Williams, 2010). The USDA Conservation Reserve Program (CRP) introduced many landowners to prairie, but prairie strips are more diverse with respect to species number and type. Prairie strips are also planted alongside corn and soybean rows, requiring precise siting, and a higher level of management. The prairie strips situation requires different knowledge and skills from CRP.

The prairie strips team needed to establish educational discrepancies for some aspects of prairie strips knowledge among advisers. An educational discrepancy is defined as a gap between an individual's current level of knowledge and the standard or desired level (Altschuld & Eastmond, 2010). Advisers would need to have knowledge and skills required by farmers and landowners, plus the knowledge of ways to assist adoption of prairie strips. We conducted a 10-item survey (Table 1) to gain information about both levels. Response options were Likert-like in structure and included an additional answer option for some items.

Table 1. Needs Assessment Survey Categories

Category	Question Items
Personal Information	<ul style="list-style-type: none"> • Occupational title and states serving • Topics and materials preferred for learning • Incentives for attending a learning event
Communication with Clients	<ul style="list-style-type: none"> • Degree of access to farmers or landowners interested in prairie strips
Prairie Knowledge	<ul style="list-style-type: none"> • Number of identifiable native prairie plants • Self-rated knowledge and skills related to prairie
Siting and Management	<ul style="list-style-type: none"> • Confidence level for consultation of prairie strips for farmers and landowners • Familiarity with siting conservation plantings

Target Audience

Agricultural advisers are employed by government and university (Extension, agency staff), nonprofit associations, agricultural retail companies (large or small seed companies) and as private independent consultants. They possess technical knowledge in key areas, hold different types of certifications, and maintain professional relationships with individuals of the community in which they serve. They may serve farmers and landowners in different states. This group generally provides products and services which provide benefits to the customers' profitability or return on investment (ROI). We compiled contacts which fit the

“Midwest agricultural adviser” construct from publicly available, online directories, such as: field crop Extension advisers, CCAs, NRCS Technical Service Providers (TSPs), Certified Professional Agronomists (CPAgs), Registered Independent Crop Consultants, prairie seed production and sales advisers, 4R Nutrient Management Specialists (4RNMSs), staff of watershed management groups, and nonprofit conservation staff (such as Pheasants Forever). We included all individuals working or serving Iowa; and many in Illinois, Minnesota, and Wisconsin.

Survey Administration

The survey was distributed to 419 contacts via the Qualtrics (2017) email distribution option in February 2017. Three email reminders were sent. Participants were not required to answer every question to have submitted a valid response. All responses were confidential and under password protection. We collected data under Iowa State University human subjects Exempt IRB ID 16-594 (Appendix B).

Analysis

Of the 419 email requests sent, 98 advisers participated. This provided a response rate of 23%. Needs assessments may have lower response rates than program evaluation surveys because there is no phenomenon (no program) to react to, as there is for an evaluation or a mandated future program, therefore this was considered to be an adequate response.

We analyzed the data and determined central tendencies using Qualtrics and Microsoft Excel 2016 for reporting and data visualization. Individual responses were categorized into nine variables we felt could predict an adviser’s confidence to provide consultations on prairie strips. Variables were created from response options we hypothesized could predict adviser confidence such as “serves Iowa” and “Technical Service Provider.” We conducted a multiple linear regression analysis to determine the best

predictors of advisers' confidence to provide consultations on prairie strips. Understanding predictors of high confidence to provide consultation could help the team in future program planning efforts. Predictor variables were coded numerically to match Likert-like levels of survey questions.

We applied the following rules to increase the quality of our analysis:

1. Only fully completed survey submissions were included in the analytical sample.
2. Measures of influence were conducted to identify survey submissions which could skew analysis of model results.
3. Alpha levels for significance were established at the .05 level.

As a result, we removed three influential observations identified using a test of Cooks distance, yielding a final analytical sample of 82 observations. An observation is considered influential if its deletion from the dataset noticeably changes the result of the calculation. Cooks distance D_i of observation i (for $i = 1, \dots, n$) is the sum of all changes in the regression model when observation i is removed from the dataset (Neter, Kutner, Nachtsheim, & Wasserman, 1996). A Cooks distance score of 1 is considered influential. Three observations fell into this category and therefore each was removed. The analysis was limited by characteristics of the dataset including the (a) lack of random sampling due to the targeted respondent group (farm advisers are a small group, and we sought to survey all in a limited area); and (b) the lack of random distribution among all variables due to the Likert-style structure of survey questions. However, all global assumptions of linear regression were met, indicating strong model performance.

Results and Discussion

Personal Information

Respondents were asked to classify their consulting role from five categories (Table 2). Fifty-six percent of all respondents identified themselves as a Technical Service Provider (TSP). The second largest group (34%) identified as a Certified Professional Agronomist or Crop Adviser. Those identifying as Cooperative Extension and seed sales were the smallest populations with 12% and 15%, respectively. Respondents were not asked to provide information on gender or age.

Table 2. Respondent Consulting Classification (n = 98)

How would you describe your consulting?	
Classification	Percentage
Technical Service Provider (TSP)	56 %
Certified Professional Agronomist/Crop Adviser (CPAg/CCA)	34 %
Cooperative Extension	12 %
Seed Sales	15 %
Other	25 %

The “Other” option made up a quarter of all respondents and included eight descriptions including non-profit staff, forester, engineer, USDA-federal partner. An additional demographic item asked each respondent to indicate their reach via the states they served. Most respondents served Iowa and Illinois, with 81% and 35% respectively. Eleven and nine percent served Wisconsin and Minnesota, respectively. However, nearly a quarter of the respondent population indicated service to a state outside of the targeted regions, including nine states in total.

Workshop Preferences

Respondents were provided a list of content areas potentially significant to their interests in prairie strips consulting and were asked to select options or add additional topics. All content areas were rated as important to respondents with no area scoring a count of less than 52 out of 98. The highest-ranking area by far was establishment cost and seed mix applications (count of 74 out of 98). Other highly desired areas were research-based benefits (of prairie strips), siting skills, research-based limitations (of prairie strips), identification of prairie plants, and research-based maintenance. The lowest preferred areas were ready-made informational materials for clients and ready access to the ISU prairie strips team with the latter scoring 52 out of 98.

Respondents were asked to select workshop characteristics that would attract them to attend a full-day event in the Iowa. The highest-ranked items were to have the workshop be within 100 miles, to experience a mix of scientist and technician speakers, and to obtain post-workshop support from the prairie strips team. Low ranked items included attending with a team, workplace support, and receiving a financial bonus.

Prairie Knowledge

Respondents were not confident in their knowledge of prairie species with 32% indicating they could identify about 30 prairie plants, 23% could identify about 15, 45% stated they could identify five or fewer, and 12% stated they probably couldn't name any native prairie species (Table 3). Only fifteen percent rated themselves as having a high ability related to prairie strips knowledge and skills. Forty-four percent indicated a medium ability and 40% indicated low knowledge and skills regarding prairie strips (Table 4).

Table 3. Quantity of Identifiable Prairie Plant Species

About how many native prairie plants could you identify (common or scientific name)?	
Category	Percentage
About 30	32 %
About 15	23 %
About 5	33 %
Probably None	12 %
Total	~ 100 %

Table 4. Knowledge and Skills Related to Prairie Strips

How would you rate your knowledge and skills related to prairie strips?	
Category	Percentage
High Ability	15 %
Medium Ability	44 %
Low Ability	40 %
N/A-Other	1 %
Total	~ 100 %

Siting and Management

Thirty percent of respondents said they were not familiar at all with laying out landscape conservation plantings (Table 5). However, 50% stated they were moderately familiar and 19% reported they were extremely familiar. When asked about their ability to provide high quality consultation on prairie strips to a farmer or landowner, 45% indicated their ability was low, 37% said their ability was medium, and 16% reported they had a high ability in this area (Table 6).

Table 5. Familiarity with Implementing Landscape Conservation Plantings

How familiar are you with laying out various conservation plantings on farmland and other landscapes?	
Category	Percentage
Extremely Familiar	19 %
Moderately Familiar	50 %
Not Familiar at All	30 %
Which in Particular? - Write in Box	1 %
Total	~ 100 %

Table 6. Confidence in Ability to Provide High Quality Consult on Prairie Strips

Overall, how would you rate your level of confidence in providing a high quality consult on prairie strips for a Midwest farmer and landowner?	
Category	Percentage
High Ability	16 %
Medium Ability	37 %
Low Ability	45 %
N/A-Other	2 %
Total	~ 100 %

Communication with Clients

When asked about their recent communication with clientele about prairie strips, 62% of respondents had never discussed prairie strips with a client. Additionally, we asked respondents to report on the amount of access they have to farmers and landowners who might be willing to adopt prairie strips. (Table 7). Twenty-one percent reported they had low access to potential adopters, nearly half said they had medium access, and 27% reported they had a high level of access to farmers and landowners who might adopt prairie strips.

Table 7. Access to Farmers and Landowners Who Might Adopt Prairie Strips

How would you rate your access to farmers or landowners who might be willing to adopt prairie strips?	
Category	Percentage
High Access	27 %
Medium Access	49 %
Low Access	21 %
N/A-Other	3 %
Total	~ 100 %

Multiple Regression Analysis

Further analysis of data from the needs assessment was used to investigate underlying characteristics of our respondents that could be indicators of an individual who is confident in their ability to coach a farmer or landowner on prairie strips. Potential variables were gathered from response options within the needs assessment. Two significant variables were identified which might predict individual confidence to provide consultations on prairie strips. Out of nine variables, “number of identifiable prairie plants” yielded significant results ($p < 0.5$) (Table 8).

Table 8. Ordinary Least Squares Model Results ($n = 82$). *Notes.* $\alpha = .05$. b = unstandardized regression coefficient. SE = standard error. T = obtained t -value. p = probability. R^2 = proportional variance explained. p -value significance 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘^’ 0.1 ‘ ’ 1.

Predictor	B	SE	\bar{X}	t	p
Familiarity w/ conservation plantings	0.193	.1375	1.858	1.403	0.164
Number of identifiable prairie plants	0.279	.0950	1.670	2.943	0.004**
Number of states served	0.008	.0864	1.541	0.102	0.919
Served Iowa	-0.432	.2582	0.811	-1.677	0.097^
Served Illinois	-0.083	.2078	0.341	-0.399	0.690
Prairie strip communication w/ client	0.091	.1557	0.411	0.586	0.559
Technical Service Provider	0.239	.1769	0.529	1.353	0.180
Certified Crop Adviser	0.215	.1792	0.364	1.200	0.234
Extension adviser	0.148	.2649	0.129	0.562	0.575
Multiple $R^2 = 0.249$	Adjusted $R^2 = 0.159$		p -value = 0.007		

The ordinary least squares regression equation estimated for this section indicates a one-unit positive change in confidence is related to a 0.279 unit change in the number of identifiable prairie plants.

Discussion

Survey results provided support for original claims in several areas and provided new knowledge in others that warranted further discussion.

1. TSPs comprised the majority of agricultural advisers in the Midwest, making up half of the respondent population. However, 13 other occupational titles were reported. This affirmed our original claim of reaching into the farm advisor sector and provided new ideas for professionals to serve.
2. Evidence from the regression analysis supported the claim that that greater knowledge of prairie identification was positively correlated with confidence in overall consulting ability. Knowledge and ability included prairie species identification, seed mixes, perennial biology, and stand ecology and succession.
3. Some advisers indicated that they had experience implementing landscape conservation plantings yet “siting skills” was also highly rated as a topic. We concluded that our respondents discerned a difference between siting prairie strips and siting a conservation planting.
4. Advisers requested content on establishment cost and seed mix applications as well as research-based benefits and limitations (of prairie strips).
5. Current adviser communication with clientele about prairie strips was reported as very low. This was expected, in part, due to the novelty of this BMP. Advisers, however, reported they had significant access to farmers they believe might adopt prairie strips. This situation

was an area we targeted for more learning by the team, and as a discussion item during workshops.

6. The project team already budgeted monetary incentives (\$250) but respondents indicated that they did not value a stipend as much as nearness, speakers from different agencies and institutions, and ongoing technical support.

Conclusions and Implications for Extension

The survey on which this article reports is not in itself the needs assessment. Needs assessment is a process which culminates the recognition of core values amongst a target audience, recognition of a context, informal prior experiences with the potential audience, the assessment and use of results to be used in program planning, and the implementation of follow-up studies to interpret program effectiveness (Altschuld & Eastmond, 2010). The survey itself contributed to our process in three key ways.

1. The needs assessment highlighted the need for emphasis on prairie identification to assist advisers to distinguish native from non-native species and other aspects of ecological succession. The theory of change states that identification of more than prairie plants will lead to better comprehension of the ways native perennial systems need to be managed within row crop systems.

2. To address the need for siting skills development, the program developed a hands-on, discussion and team-based siting case study for the workshop that utilized soil, topography, and hydrology maps, examples from real cases, and current landowner practices and preferences. To further address the need for knowledge and skills related to prairie strips, research-based impacts and incentive program eligibility are included in the workshop agenda.

3. To support development of communication abilities, the program team designed a discussion-based mock scenario based on interview data from cooperating farmers and landowners to address agronomic, financial, and interagency issues.

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CHAPTER 4. EVALUATING OUTCOMES OF A PROFESSIONAL DEVELOPMENT PROGRAM ON PRAIRIE STRIPS FOR FARM ADVISERS

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Abstract

Prairie strips is a conservation Best Management Practice (BMP) that offers comprehensive benefits to farmers and landowners, yet adoption is limited due to several factors. To increase technical support, the Become a Prairie Strips Consultant program was designed to educate agricultural advisers in the Midwest on prairie strips implementation, management, and communication with potential adopters. Five workshops were held throughout Iowa in summer and fall of 2017. An outcomes evaluation of a workshop series was conducted using a pre and post test, and a survey to report on workshop performance, attainment of learning objectives, and to make program improvements. The evaluation documented improvement in adviser skills and confidence regarding prairie strips communication and management, however, advisers' ability to identify early establishment age of prairie strips did not. The workshop was reported as highly valuable; however additional supports were requested for skill areas.

Introduction

Agricultural conservation Best Management Practices (BMPs) are intended to benefit farmers, landowners, and the public by providing ecological services and protecting soil quality and productivity, yet adoption is slower than for other agricultural technologies (Bates & Arbuckle Jr., 2017). Prairie strips is a conservation BMP which became available in the Midwest in 2014. Prairie strips perform better in the areas of sediment and nutrient control, and biodiversity improvement, when compared to other BMPs (Asbjornsen et al., 2013; Schulte et al., 2017). Prairie strips are planted directly into row crop fields in 20-30-foot strips where ideally, they grow undisturbed as perennials for ten or more years. Prairie

strips are composed of tall grass prairie species, including native C3 and C4 grasses, sedges, rushes, legumes, and forbs and act as a filter when seeded perpendicular to water flow (Schulte et al., 2017). They must be managed differently than annual crops, such as corn or soybeans. Ample technical support opportunities are needed so that farm advisers, and farmers and landowners, become proficient in management of prairie strips.

Extension and Outreach Education

The STRIPS team at Iowa State University and partner organizations set goals for Extension education and outreach. The team has developed print, video, and other web-accessible materials, and cooperated with partner programs to provide presentations and to conduct field days (Comito, Pierce, & Stevenson, 2018). Cooperator surveys have identified prevalent issues experienced by early adopters of prairie strips (Arbuckle, 2016; 2017; 2018). To enlarge the number of professionals prepared to introduce and troubleshoot prairie strips installation, the two-year program, Become a Prairie Strips Consultant, was offered in 2017. The program was developed, in part, based on a needs assessment survey in February 2017 of farm advisors in the Midwest (Whitehair & Grudens-Schuck, 2017). The key findings of the needs assessment included:

1. Self-rated knowledge and skills related to prairie species identification, composition of seed mixes, ecology of perennial plantings were low.
2. Awareness of research-based characteristics of prairie strips impacts was low.
3. Advisers rated their access to potential adopters as high.
4. A moderate percentage of respondents reported moderate familiarity with implementing landscape conservation plantings yet listed knowledge of prairie strips design as low.

5. Advisers wanted to better understand access financial incentive programs on behalf of clients.

Three Part Curriculum

Part I of the 2017-2018 Iowa State University Extension and Outreach program consisted of a full-day workshop featuring cognitive and application activities: hydrology, prairie, and finances; planning and siting exercises; and role play communications discussions regarding potential clientele.

Part II emphasized application, and creativity. It required participants to create a communication piece (blog, video, pamphlet, app, grant proposal, radio/podcast) about prairie strips for use in their business or organization and was reviewed by the team for science and economic content.

Part III combined analysis, evaluation, and generative knowledge. It partnered a member of the prairie strips team with a farm advisor to implement prairie strips on a client's land.

Financial subsidies were provided for the workshop (\$250) and for the client implementation (\$1,000).

Purpose & Objectives

The purpose of the study was to collect, analyze and report short term programmatic outcomes following the professional development workshops for farm advisers (Part I of the three part program).

1. Evaluate changes in participant ability and confidence in areas crucial to providing effective coaching on prairie strips; prairie plant and weed identification, siting and design of prairie strips, communication with clientele, and assessment of prairie strips planting condition during the early years of establishment.

2. Determine rating of effectiveness by participants of specific instructional approaches (prairie identification instructional artifacts, i.e. fresh plant samples, species posters, identification guides, self-tests, and coaching).
3. Assess the extent to which participants rated the workshop series as successfully communicating topics of prairie strips research, precision technology, quality prairie seed, and federal or other subsidy program eligibility.

Theoretical/Conceptual Framework

The frameworks that informed the evaluation drew upon program planning and evaluation knowledge regarding professional development for adult learners, and outcomes evaluation used in the Cooperative Extension system. Caffarella and Daffron's (2013) Interactive Program Planning Model contains 11 components, one of which is dedicated to planning effective evaluation.

Evaluations can focus on assessing program goals, processes, or outcomes. Rector et al. (2016) used a process evaluation with a case study and historical review to assess the integrity of a long-term environmental education program compared to original foundational goals and expectations. Hess and Eckman (2002) also utilized a process-based approach by holding experiential workshops to prepare chicken flock advisors to evaluate the biological principles of field situations. Baughman et al. (2010) evaluated outcomes of an Extension professional development program involving the use of learning communities as a professional development strategy for 4-H educators.

Logic modeling is a common outcomes-based tool used within the Cooperative Extension System to maintain accountability (Knowlton & Phillips, 2013). Many variations of logic models exist, however, those most popularized depict evaluation as a component that spans the entirety of the program planning process. Evaluation is charged with monitoring

inputs, assessing and reporting outputs, and estimating outcomes of a program. This information is reported to program staff, stakeholders, and funders to consider, with the intention of communicating change and recommending future changes and improvements (McDavid & Hawthorn, 2006). The logic model uses formalized definitions of inputs, outputs, and outcomes. Other terms associated with the model, including impact, are less rigidly defined (Jones et al., 2019). The Extension system has regularly used an outcomes approach organized by a logic model since the Government Performance and Results Act was passed in 1993 requiring “all federal agencies to develop measurable performance objectives as part of the budget process” (Rennekamp & Engle, 2008, p. 18). Balancing the needs of the reporting audience with appropriate data collection and reporting methods is a critical skill of evaluators who utilize outcomes to communicate impact and make recommendations about future efforts (Rennekamp & Engle, 2008). The logic model for the Become a Prairie Strips Consultant Program is located in Appendix A.

Methods

Multi-site Evaluation

Seven workshop events were planned in different regions of the state; one two-hour pilot and six day-long workshops. The first day-long workshop served as an additional pilot to the two-hour event due to restructuring of the agenda, curriculum artifacts and evaluation materials. Throughout the pilot sessions, the team refined the curriculum to include a hands-on siting activity, additional artifacts for learning prairie identification, and refined the pre and post skills test of assessing the establishment year of prairie in early stages of succession. Six workshops were held (one day-long workshop cancelled due to low registration) (Table 1). Ninety-one attended in total, with 62 attending the five day-long workshops. The latter

four of the five day-long workshops maintained fidelity to a standard curriculum and provided an opportunity for multi-site evaluation.

Table 1. Outputs: Workshop Summary. *Note.* One workshop was cancelled due to low registration. The location is not provided. *Northeast [STATE] Community College (NIACC). **Des Moines Area Community College (DMACC).

Location	Date	No. of Registrants
Scheman Building, Ames (pilot 1) (2 hours)	Feb. 5	29
Wallace Learning Center, Lewis (pilot 2) (Day-long)	July 12	14
Dairy Education Center, Calmar. (Day-long)	Aug. 3	13
Clock Tower Business Center, NIACC*, Dubuque. (Day-long)	Sep. 11	11
Hawkeye Community College, Waterloo. (Day-long)	Oct 17	8
FFA Enrichment Center, DMACC,** Ankeny. (Day-long)	Nov. 2	16

The workshop served as fundamental scaffolding to attain successive outcomes of the program, that, contribute to the support of community multiplier parties and the larger context of adoption (Borich, 1983; 2007). The workshop was required before participants participated in Part II or Part II of the program. Workshop events maintained similar itineraries and included presentations from a variety of multidisciplinary professionals including project team staff, university specialists, Extension professionals and partners from private organizations. The day-long events were a mix of lecture, group work, and discussion. Two instruments were used to evaluate learning outcomes, a pre and post test and a follow-up survey.

Pre and Post Skills Test

A pre and post instrument was used during the workshop to assess acquisition of ability to evaluate the age of a prairie succession within the early years of establishment. Prior to instruction, participants were each given eight numbered photos of a prairie strips.

The photos did not reveal the age (year) of establishment, and none of the scientists provided this during the pretest. The photo assessment samples had been developed by a team of five planners for clarity and representativeness for ecological succession, and local seed mixes. They were piloted and edited after use during workshop pilot 1 (Lewis). Participants were asked to match each photo with the correct season and age (year) options listed on a separate worksheet. Pretests and photos were collected anonymously and stored. Participants were not provided the key to the photos. They then engaged in the following curriculum topics: (1) prairie species identification, (2) siting design applications, and (3) prairie strip succession and management. Participants handled live plant samples, watched PowerPoint lectures with photos of prairie, and discussed weed vs. native plants. Additionally, participants were given a practice test on selected prairie plants and weeds using individual copies of pre-labeled guidebooks as keys.

Following exposure to the curriculum, participants were given an identical posttest which was collected anonymously and then reviewed. Within- group pretest design lets each participant serve as their own control (Pratt, McGuigan, & Katzev, 2000). Limitations for this design are that evaluators did not utilize a two-group method with a control and treatment. Research suggests a pre and post skills test tailed by a follow-up self-report survey can improve validity of assessed change following instruction (Nimon, Allen, & Zigarmi, 2011).

Evaluation Survey

This report assesses the effectiveness of the latter four day-long workshops following the two pilot events. Participants from the workshops were sent an electronic survey within one week after each of the four workshops via email using the software system Qualtrics (2017), with two reminders. From the attendee population of 48, a total of 41 responses were

received giving a response rate of 85%. Incomplete surveys with one or more responses left blank were not removed from the pool. Survey question responses answered “NA” (Not Applicable) were not included in the dataset.

Question Types

The survey consisted of three types of questions: (a) Likert-type (b) retrospective self-reports, with Likert-type scale, and (c) check all that apply. Likert-type questions regarding changed skills and confidence are primarily based on the “perceived change” (or post-then-only) method whose validity was demonstrated for this type of context by Lam and Bengo (2003) and Nimon, Zigarmi, & Allen (2011). Retrospective self-report questions utilized a “retrospective pretest” methodology (Lamm & Bengo, 2003; Nimon, Zigarmi, & Allen, 2011; Pratt, McGuigan, & Katzev, 2000). Questions asked respondents to assess skill aptitude both before and after (now) the workshop. Skill areas included as retrospective questions were (a) siting ability and (b) ability to assess the age of a prairie strips planting. Because both “Before” and “Now” tests are done concurrently, the standard of measurement for each participant should be on the same scale for both.

Twenty-two Likert-style questions asked advisers to report on (1) changed skills and confidence related to prairie strips consulting, (2) effectiveness of prairie artifacts and photos, and (3) workshop value and performance. In addition, the survey requested information about current attitudes and client communication surrounding the prairie strips practice and preferences regarding ongoing practice and supports.

Results

Participant Demographics

Of the 48 advisers who registered for the four day-long workshops included in the evaluation, 26 (54%) were male and 22 (46%) were female. Advisers originated from four

states including Iowa (67%), Wisconsin (27%), Nebraska (4%), and Illinois (2%).

Occupational titles of registrants were organized into eight adviser categories (Figure 1). Age information was not requested.

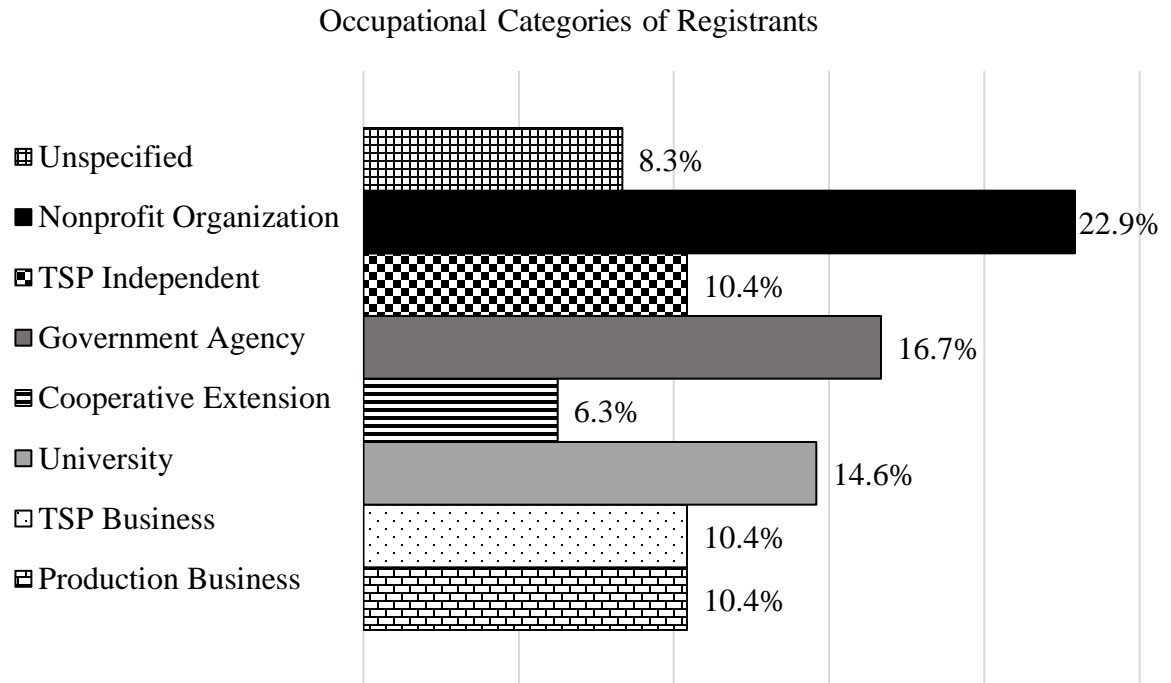


Figure 1. Occupational Categories of Registrants (N=48). TSP= Technical Service Provider.

Skills

The two retrospective self-report questions regarding siting ability (Figure 2) and ability to assess the age of a prairie strips planting in the early years of establishment (Figure 3) yielded positive growth in skills confidence.

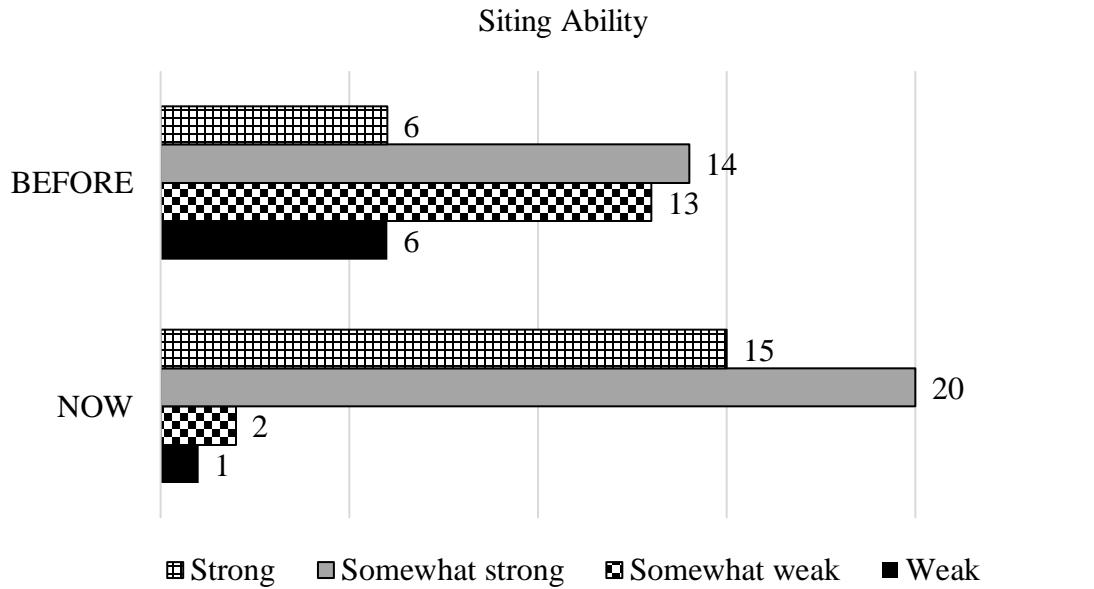


Figure 2. Retrospective Self-Report on Siting Ability (N=39). Legend indicates Likert-style response scale.



Figure 3. Retrospective Self-Report on Ability to Assess Age of a Planting (N=39). Legend indicates Likert-style response scale.

Collectively, respondents reported that they increased their skillset in both siting a new prairie strip during the planning stage, and their ability to assess the age of a prairie

planting. Eighty-seven percent said they were confident in their ability to complete initial steps of creating maps at a client's request.

Prairie Stand Assessment

Results of the pre- post-test allowed the team to evaluate how well trainees grasped the ability to assess establishment age of a prairie establishment in the early years of succession (Figure 4).

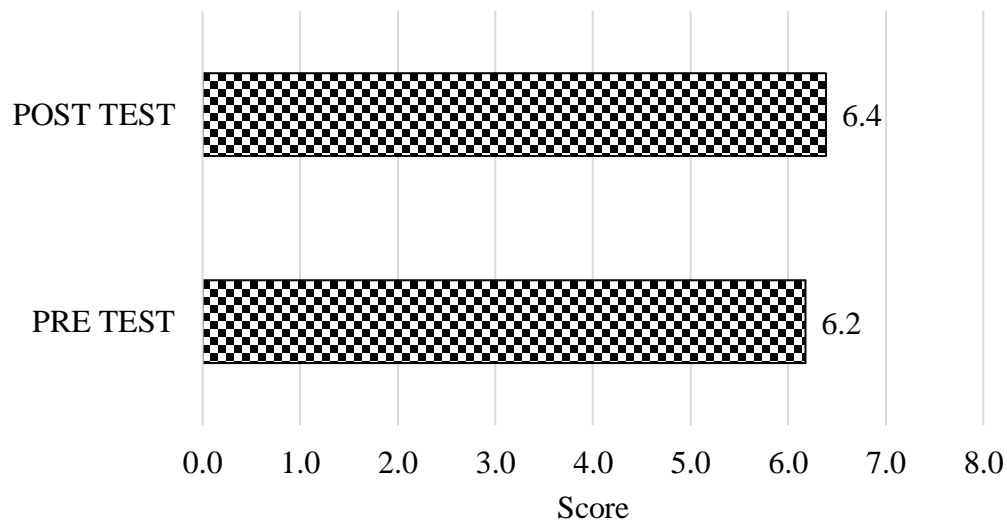


Figure 4. Establishment Year Identification Pre and Post test Results. (N=49). The pre and post skill test involved the identification of eight photos.

With eight as the perfect score, the average pre-test score was 6.2 and the average post-test score was 6.4 indicating participants' average scores showed very slight growth following the posttest. The reader should note that scores ranged more widely on average in the post-test (3.1-7.4) than the pre-test (4.7-6.8).

Workshop Performance Indicators

Regarding overall workshop performance, 81% of participants indicated the workshop was highly valuable and 93% would recommend to other advisers. We asked respondents to report on the performance of individual areas presented at the workshop.

Eighty-three percent said they would recommend precision technology applications as a tool for consulting on prairie strips design. About 50% reported the economics area of the workshop addresses program eligibility for prairie strips adequately and 41% said program eligibility was only somewhat addressed. Sixty-one percent said the workshop conveyed the importance of high-quality prairie seed adequately and 30% said this impact was conveyed well. Respondents reported which beneficial impacts of the practice were convincingly addressed (Table 2).

Table 2. Prairie Strips impacts addressed during workshop. *Note.* Multiple Responses permitted

Which impacts of prairie strips were convincingly addressed in the workshop?	
Impact	Count
Prairie plants have deep roots that hold soil and nutrients in place	36
Potentially improve beneficial insect and wildlife populations	35
Prairie plants have stiff upright stems that stay in a pounding rain	33
Prairie strips are effective when added at just the 10% level	32
Phosphorous is reduced by 90%	30
Cheaper than terraces.	28
N is reduced by 84% (70% for subsurface No30N)	27
There is a 44% reduction in water run-off	26
Do not reduce per acre yields	25
Do not create a weed problem	23
Costs are comparable to cover crops	22

Additionally, 96% of respondents stated they understood the consultant role and 86% reported they had sufficient tools to provide technical assistance as well as communicate research benefits of prairie strips to farmers and landowners.

Prairie Curriculum Effectiveness

The survey asked about the effectiveness of prairie identification curriculum and artifacts (Table 3). Additionally, 72% of respondents indicated they experienced improvement in their ability to distinguish between beneficial and weed species. Regarding the effectiveness of prairie photos, 72% of participants indicated the photos played a strong role in aiding ability to identify age of a planting.

Table 3. Prairie Identification Artifact Effectiveness

Artifact	% who found artifacts helpful
Photos of prairie plants and weedy look-a-likes	77%
Availability of fresh plant samples	74%
Availability of identification guidebooks	79%

Attitudes Towards Prairie Strips

Sixty-three percent of respondents reported that the farmers they worked with are influential with respect to helping others adopt conservation practices. Regarding broader adoption of prairie strips, 95% of participants viewed prairie strips as compatible with other conservation BMPs and 93% expressed that the practice was ready to be broadly communicated. Even though 84% believed prairie strips will be a commonly applied BMP within 25 years, about half thought that only a small number of farmers would adopt prairie strips with 46% who believed more research is needed before broad adoption.

Support Preferences

Participants were asked during the post-workshop survey to select areas they felt additional practice or support would benefit their consulting efforts and education on prairie strips (Table 4).

Table 4. Post-Survey Requested Content. *Note.* Multiple responses permitted
With which topics would you benefit from additional practice or support?

Topic Area	Count
Economics/ Cost assessment of prairie strips	29
Farm assessment and siting of prairie strips	25
How to price consultant services	19
Communication with farmers and landowners	18
Research based impacts of prairie strips	16
Management of prairie strips in years 1-3	16
Weed vs. Prairie Species Identification	12
Prairie plant Identification/Ecology	11

Sixty six percent said they knew three or more people who could offer support at some phase of prairie strips consulting. Thirty percent indicated they only knew one or two individuals who could offer support. We asked participants what supports the Prairie Strips team could lend to their practice (Table 5).

Table 5. Post-Survey Participant Requested Supports

What Support/Resources from the prairie strips team would be valuable to you as you proceed through the certification process?	
Topic	Count
Guidance with the communications piece	24
Notification of other prairie strips education events	24
Maintenance Reminders	20
Prairie/Weed Identification practice	17

All topic areas listed were highly requested with guidance on Part II and notification of future prairie strips related events listed equally of the highest preference.

Discussion

Prairie Plant Knowledge and Skills

The prairie plant and management identification area provided complex, even conflicting, results, across the needs assessment and evaluation. First, our professional experiences had already prepared us to realize prairie identification was important to prairie strips implementation and management. Second, the needs assessment data and regression analysis alerted us to an educational gap related to prairie ID and planting prairie (Whitehair & Grudens-Schuck, 2017). Third, we put effort into multi-modal education by including experts, live samples, guidebooks, pictures, and practice activities which were well received. The average of the post test scores themselves were moderate (6.4 out of 8). Regardless, the pre and post skill test reported no growth overall among our participants. For increased confidence and flat line performance, and in the absence of other data, we suggest possibilities to explain this.

One such possibility to the absence of skills growth is the relationship between aspects of the curriculum design that fall within the three domains of learning; the cognitive (knowledge), the affective (feelings/emotions), and the psychomotor (manual skill). Within the cognitive domain, Anderson & Krathwohl (2001) describe six functions, listed from simple to complex (remembering, understanding, applying, analyzing, evaluating, creating). The pre and post assessment asked the advisers to engage in higher the order function of analyzing a prairie establishment. The curriculum itself incorporated both cognitive engagement to memorize and compare species, and psychomotor engagement to create a prairie strips design using maps. Considering the complex functions required of the curriculum and the pre and post test, more time and organization could be required prior to skills improvement testing for a learner to fully engage with the material.

Moreover, the material itself is based on the complex system of prairie. Complex systems can be difficult for learners to grasp through mere observation and participation and require higher order engagement to comprehend (Hmelo-Silver & Pfeffer, 2004). Hashem and Mioduser (2013) describe modeling as an effective strategy for learning complex systems. Modeling activities, like case studies, allow learners to create questions and theories about phenomena and then build and run models related to their theories.

Growth within the affective domain could potentially explain the contrast between results of the retrospective self-efficacy questions and the pre and post skills assessment. The standard level of performance differs between the team members who are highly familiar with prairie systems and workshop participants who may have just been introduced to a prairie system. The amount of growth experienced by our attendees may have been experienced as high because of the emotional reward felt for correctly placing the majority of photos. The degree of growth made by each individual from a skills perspective may not have been as apparent.

Workshop Performance

Our Part I participants expressed confidence in their ability to communicate research-based benefits of prairie strips during farmer/landowner engagement. However, when we asked advisees which research-based impacts were convincingly communicated, the bottom scoring impacts are all related to economic factors (Do not reduce per acre yield, do not create a weed problem, costs are comparable to cover crops). They were also less confident in their knowledge of economic and financing aspects of prairie strips. If advisers are not convinced on impacts of prairie strips related to cost, they are less likely to communicate them to clientele. Berns et al. (2013) suggested an audience easily accepts information that is tailored to align with their identities and values. Moreover, the use of

relatable, visually appealing stories, including farmer testimonials, can serve as a strong connector between the adviser and the impact being conveyed (Christiano & Neimand, 2018).

Conclusions/Implications/Recommendations

The results of this evaluation allow us to make several conclusions and recommendations for future adviser professional development events in the area of conservation BMPs, particularly prairie strips or native planting programs for farmers and landowners. These programs may be pollinator-related or water quality related.

Prairie Curriculum Development

The self-reports were rated higher than those of us trained in the scientific standard would support, and as were warranted by the pre and post test results. Moreover, the prairie identification practice was the least requested topic for follow up support, in fact, last on the list of areas in need of additional practice.

There are several ideas we could bring to bear to assist with future planning efforts for curriculum development and delivery:

Curriculum Recommendations

- a. Distribute pre-event materials such as knowledge surveys, informational material and webinars to cover background information needed to conduct higher order tasks. Participants can then arrive to the event with basic acquired knowledge. This will allow workshops to be more dedicated to hands-on learning.
- b. Engage learners in multiple modeling activities such as case studies. Use visual, figurative language to describe prairie habitat.
- c. Fitting the assessment objective into a single full-day event might not be feasible. We recommend breaking the prairie system down into separate,

digestible concepts that grow in complexity:

Prairie System Concepts

1. Ecology and structure of grasses vs. forbs
2. Native vs. nonnative grass species
3. Native vs. nonnative forb species
4. Ecology of native vs. nonnative species
5. Height of prairie over time
6. Seasonality of prairie species
7. Succession of prairie species diversity over time
8. Prairie ecosystem service interactions
9. Case study-based assessment of early prairie establishment

Based on team experience and input from cooperators, we confirm that skills in the areas of prairie plant identification, differentiation between beneficial and weed species, and an understanding of prairie succession are important to an ability to judge establishment age and success. A basic knowledge of prairie or weed species is not sufficient to provide effective consultation on prairie strips. If advisers are not proficient in these areas, they cannot provide effective consultation to farmers and landowners. This could cause (a) low adoption, (b) degradation of prairie strips they assist to put into place, and (c) discontinued adoption.

Reaching Advisers

Workshop participants came from several additional occupational areas, of which, TSPs made up 20 percent, a smaller than expected portion. From the needs assessment phase we learned the majority of the audience of Midwestern advisers were TSPs. Research suggests that TSPs are among the most trusted individuals by farmers

when it comes to receiving management and conservation related information due to their existing relationships with clientele, and ability to connect science-based information to adaptive on-farm management (Bernacchi & Wulfhorst, 2017).

We recommend directing advertisement strategies to reach these groups in addition to others who attended. In addition, advisees were interested in learning more about business aspects of consulting. Perhaps incorporating this content area in future workshops, offering professional networking events, giving opportunities for FAQ webinars may invite more of the TSP population. In addition, surveying future workshop attendees on their motivations to participate may provide insight on professional development characteristics important to advisers.

Workshop Development

Participants were optimistic about the use of precision technology tools for consulting purposes. These tools serve to identify the least profitable areas of land that can be capitalized on by exchanging crops in those areas to perennial land cover. We also recommend the development of these tools and the collection of first account cases where these applications improved the farmer or landowner's return on investment.

Research shows the greatest barrier to widespread adoption of conservation BMPs is financial risk. This risk can take form as startup and opportunity costs associated with installing conservation BMPs or can include the result of taking acres out of production. As incentive programs like EQIP are describing conservation land practices within their guidelines similar to diverse perennial practices like prairie strips, we recommend the team may want to focus curricula for advisers on cost calculators and other aides; or the issue may be a question of reassessing the policy climate, especially Farm Bill provisions, which had not at the time included prairie strips to the fullest

extent. Educating advisers in prairie strips management and communication requires an outcomes focused delivery and evaluation approach. As recognition of the prairie strips practice grows from federal publicity, ongoing research is needed to evaluate impacts of prairie strips and support effective programming for advisers.

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CHAPTER 5. GENERAL CONCLUSIONS

- The needs assessment confirmed that there are a high number of advisers serving in roles of private, independent, government, and/or non-profit staff. These are agricultural advisors within the Midwest region that potentially may support the adoption of prairie strips by farmers and landowners. The Become a Prairie Strips Consultant program did not attract many advisers in comparison to the total number of parties registered online as Technical Service Providers, Certified Crop Advisors, or Certified Professional Agronomists. Program attendance averaged 12 participants per face-to-face workshop. One event was cancelled due to low attendance.
- Multiple indicators from the thesis study showed that an educational gap existed among participants in the area of prairie ecology and succession. A regression analysis supported that an adviser's confidence to provide effective consultation correlated positively with a greater ability to identify prairie species. The workshop consisted mostly of curriculum dedicated to growing these skill areas. Several techniques were used to teach this content including visualization, practice tests using live samples, guidebooks and pictures of prairie strips and weed -prairie side by side look-a-likes. Despite these, participants showed no gain from the pre and post skill test. However, participants rated their skills as improved as a result of the workshop. Ambiguity exists between perceived skill acquisition and meeting a scientific standard. I recommend a dedicated development of this curriculum, with educational research behind it, on how to teach prairie identification skills, fairly quickly. It was assumed that some advisers would enter the workshop experience with a basic knowledge of this content (some did), but most did not. However, experience will likely continue to vary. Administering a knowledge pre-test to registered parties to create a

baseline prior to training may prove helpful. This will allow program staff to tailor instruction to the current abilities of the upcoming audience.

- Ongoing evaluation of the program should accurately assess the impact of the work completed, address the needs of stakeholder parties, and be economical. Web-based surveys provided helpful findings that allowed the evaluation team to draw conclusions that communicate outcomes and can contribute to program growth. However, this method has limitations to its effectiveness and in collecting the entire story. Assessing outputs and impacts of consulting efforts made by former advisees is a multifaceted and complex endeavor. For future evaluation planning regarding Part II and III of the program, I recommend incorporating additional modes of data collection. Suggestions include follow-up phone interviews, personal interviews, and focus group discussions.
- One of the largest requests following the needs assessment was the desire for multi-occupational speakers. The Prairie Strips team currently maintains and continuously builds its network of partnerships and stakeholder groups. Multidisciplinary partnerships work well as a method to gain momentum for the outreach and education phase of adoption (Rogers, 2003). The 2018 Farm Bill includes prairie strips as an accepted practice under the Conservation Reserve Program. The up swell of publicity following this inclusion should be taken advantage of as an opportunity to build additional partnerships with state and federal organizations. I recommend the Prairie Strips team continue to learn from organizations such as The Tallgrass Prairie Center at the University of Northern Iowa, The Neal Smith National Wildlife Refuge, The Iowa Agriculture Water Alliance, and The Sand County Foundation in Wisconsin. These supportive alliances offered additional expert speakers and funding which made additional events possible. In addition, partnerships with corporations like Roeslein

Alternative Energy and EFC Systems will attract an even broader group of producers to learn about the benefits of the practice.

- The needs assessment and evaluation suggest advisers already have established relationships with influential farmers open to considering prairies trips. Many farmers already utilize practices somewhat like prairies strips such as grassed waterways, filter strips, and buffers. These individuals already have ground allocated to conservation and may be more prone to converting to a more diverse perennial mix. Incentive program enrollment guidelines currently pose an issue to this type of transformation. The NRCS is currently developing a federal definition of prairie strips and recently released available funding for CIG/EQIP grants describing practices very comparable to prairie strips. I recommend targeting farmers and landowners who are able and willing to transform their established perennial ground as opposed to designing a new implementation plan. This may or may not affect potential to adopt for leasing farmers. To further address the communication factor, providing specific and meaningful calls to action may help to align state conservation goals with farmer and landowner values. Soil health and the legacy value of one's farm were determined by 4R Plus Program market research to be the messages that resonated the strongest with them. Conveying information to advisers through these two lenses may help advisers to further connect with farmer and landowner identity and values.
- Additionally, private providers continue to merge from the sale of product to the sale of information and expertise. Advisers voiced they felt unprepared to conduct business aspects of a consulting practice and requested additional information in this area. In response, a video interview with long-term private consultant, Joe Lally, was produced in response to this request (Grudens-Schuck & Whitehair, 2018). I recommend dedicating efforts to developing

more educational materials and trainings in this area to grow this movement amongst the profession. This could include access to prepared farmer and landowner testimonials, which were requested multiple times by workshop attendees.

CHAPTER 6. ACKNOWLEDGEMENTS

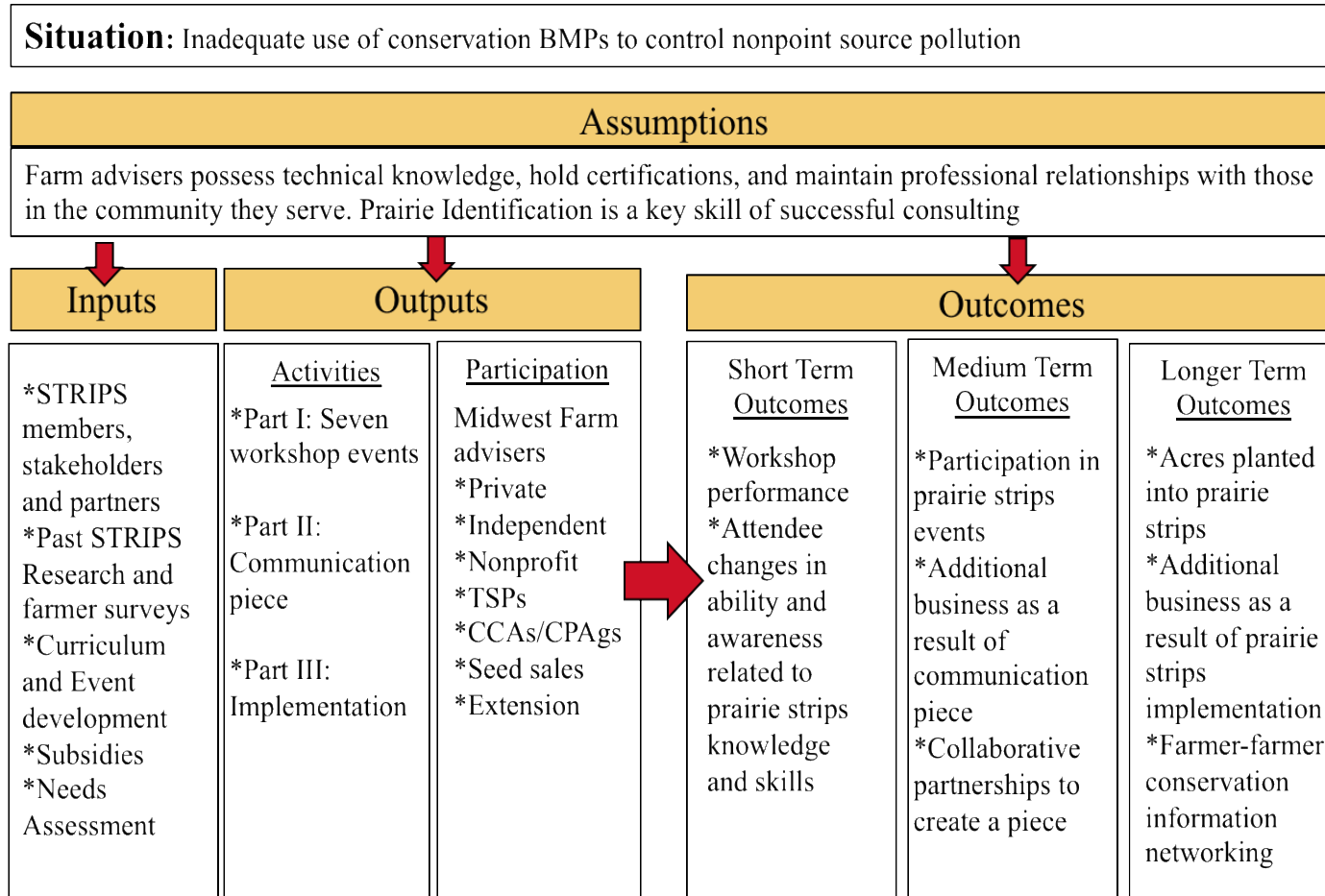
I would like to thank funding partners of the STRIPS team who helped to make this program possible: The McKnight Foundation, National Fish and Wildlife Foundation, and Iowa Agriculture Water Alliance.

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APPENDIX A. LOGIC MODEL SCHEMA

Program Logic Model: Become A Prairie Strips Consultant



APPENDIX B. WORKSHOP PILOT 2 DATA

Table 1. Pilot 2 Workshop Evaluation Data (n=6)

Survey Question	Response Option (Frequency)
Overall, how would you rate the value of the workshop?	Very low (0) Low (1) Medium (1) High (4) Very high (0)
How confident are you in your ability to accurately communicate the research-based benefits of using prairie strips?	Somewhat confident (2) Confident (3) Highly confident (1)
Which impacts of prairie strips were convincingly addressed in the workshop? <i>Note* Multiple responses permitted (of 6)</i>	Prairie plants have deep roots that hold soil and nutrients in place (5) Potentially improve beneficial insect and wildlife populations (6) Prairie plants have stiff upright stems that stay in a pounding rain (6) Prairie strips are effective when added at just the 10% level (5) Phosphorous is reduced by 90% (6) Cheaper than terraces. (5) N is reduced by 84% (70% for subsurface No30N) (6) There is a 44% reduction in water run-off (5) Do not reduce per acre yields (5) Do not create a weed problem (5) Costs are comparable to cover crops (6)
Indicate the level of potential you see for prairie strips to become a common Best Management Practice in the state of Iowa within the next 25 years.	Low potential (0) Some potential (0) Moderate potential (2) High potential (3) Not sure/ I can't answer (1)
To what extent did the economics area address program eligibility for prairie strips?	Not at all (0) Somewhat (2) Adequately (3) Well (1)

The prairie strips technology is ready to take off	Strongly disagree (0) Somewhat disagree (0) Somewhat agree (3) Strongly agree (3)
Prairie strips need more research before being adopted broadly	Strongly disagree (0) Somewhat disagree (1) Somewhat agree (4) Strongly agree (1)
Prairie strips will only be used by a small number of farmer/landowners	Strongly disagree (0) Somewhat disagree (6) Somewhat agree (0) Strongly agree (0)
Prairie strips fit well with other BMPs	Strongly disagree (0) Somewhat disagree (0) Somewhat agree (1) Strongly agree (5)
I understand what it means to be a prairie strips consultant	Strongly disagree (0) Somewhat disagree (0) Somewhat agree (2) Strongly agree (4)
I have the tools to consult on prairie strips	Strongly disagree (0) Somewhat disagree () Somewhat agree (2) Strongly agree (3)
I would recommend this workshop to other conservation consultants	Strongly disagree (0) Somewhat disagree (1) Somewhat agree (0) Strongly agree (5)

To what extent would you recommend precision technology to clients considering prairie strips?	<p>Would not recommend (1)</p> <p>Might recommend (0)</p> <p>Would recommend (1)</p> <p>Would highly recommend (4)</p>
To what extent did the workshop convey the importance of high-quality prairie seed?	<p>Not at all (0)</p> <p>Poorly (0)</p> <p>Adequately (4)</p> <p>Well (4)</p>
How strong a role did the photos of prairie strips play in helping you to identify the stage (year) of establishment?	<p>Weak (1)</p> <p>Somewhat weak (2)</p> <p>Neutral/ Not sure (1)</p> <p>Somewhat strong (2)</p> <p>Strong (0)</p>
To what extent did the prairie ID section improve your ability to distinguish prairie plants from weeds?	<p>Did not improve (1)</p> <p>Barely improved (1)</p> <p>Somewhat improved (3)</p> <p>Strongly improved (1)</p>
Helpfulness in year ID- Photos distinguishing prairie plants from weedy look-a-likes	<p>Not helpful (1)</p> <p>Somewhat helpful (1)</p> <p>Generally helpful (1)</p> <p>Very helpful (3)</p>
Helpfulness in year ID-Availability of live plant samples	<p>Not helpful (0)</p> <p>Somewhat helpful (1)</p> <p>Generally helpful (0)</p> <p>Very helpful (4)</p>
Helpfulness in year ID- Availability of identification guide books	<p>Not helpful (0)</p> <p>Somewhat helpful (2)</p> <p>Generally helpful (1)</p> <p>Very helpful (3)</p>

If a client requests a design for prairie strips, how confident are you in your ability to complete initial steps of creating maps?	Not confident (1) Low confidence (1) Confident (3) Highly confident (1)
How many people do you already have relationships with that you could call upon for support with some phase of prairie strips consulting?	0 (0) 1-2 (3) 3-4 (2) 5+ (1)
How influential are the farmers that you work with respect to helping others adopt conservation practices?	Not influential (0) Barely influential (0) Influential (6) Very influential (0)
What Support/Resources from the STRIPS team would be valuable to you as you proceed through the certification process? <i>Note* Multiple responses permitted (of 6)</i>	Guidance with the communications piece (4) Notification of other prairie strips education events (3) Maintenance Reminders (2) Prairie/Weed Identification practice (2)
With which topics would you benefit from additional practice or support? <i>Note* Multiple responses permitted (of 6)</i>	Economics/ Cost assessment of prairie strips (4) Farm assessment & siting of prairie strips (5) How to price consultant services (4) Communication with farmers & landowners about prairie strips (3) Research based impacts of prairie strips (3) Management of prairie strips in years 1-3 (3) Weed vs. Prairie Species Identification (3) Prairie plant Identification/Ecology (2) Precision Technology/ EFC Systems Applications (3) Best use of resources on the flash drive (2)

In the last week, how often have you accessed a resource material on the flash drive?	0 (1) 1 (3) 2 (2) 3+ (0)
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APPENDIX C. IRB FORM

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
2420 Lincoln Way, Suite 202
Ames, Iowa 50014
515 294-4566

Date: 2/16/2017
To: Nancy Grudens-Schuck
217 Curtiss Hall
From: Office for Responsible Research
Title: Prairie Strips Consultant Program
IRB ID: 16-594

Study Review Date: 2/16/2017

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (1) Research conducted in established or commonly accepted education settings involving normal education practices, such as:
 - Research on regular and special education instructional strategies; or
 - Research on the effectiveness of, or the comparison among, instructional techniques, curricula, or classroom management methods.
- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
 - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
 - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed**. For example, access to data from private records (e.g.

Modification Information

Please provide answers to all questions, except as specified. The fields will expand as you type.
Incomplete forms will be returned without review.

<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Was your project initially determined to be eligible for exempt review? <i>This information can be found in the approval letter you received when the study was last reviewed.</i>
If No, STOP! This is not the correct form! Please submit a <u>Modification Form for Non-Exempt Research</u> form instead.	
If Yes, please complete Parts A and B below.	

Part A: Changes in Personnel

<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	1. Does the modification involve a change in Principal Investigator? If Yes, STOP! The new principal investigator must submit a completed new <u>Exempt Study Review Form</u> .
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2. Are you adding or removing members of the key personnel? If Yes, complete Table A.1 below.

Table A.1

1. List any individuals that are no longer part of the key personnel:						
2. Complete the following table to list any new key personnel:						
NAME	Interpersonal contact or communication with subjects, or access to private identifiable data?	Involved in the consent process?	Contact with human blood, specimens, or other biohazardous materials?	Other Roles in Research	Qualifications (i.e., special training, degrees, certifications, coursework, etc.)	Human Subjects Training Date
Rachael Whitehair	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	data analysis	21702787 CITI S/B	26-Jan-17
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			